

INVENTIONS & INNOVATION

Project Fact Sheet



ENERGY-SAVING LIGHTWEIGHT REFRACTORY

BENEFITS

- Offers potential energy savings of 25 to 50 percent compared to conventional silicon carbides
- Three times stronger than silica or clay-bonded silicon carbide (15,000 psi versus 5,000 psi)
- Offers ability to manufacture thinner, lighter shapes
- Performs similarly to recrystallized SiC with temperature resistance up to 1550°C
- Provides oxidation protection without the need for a second firing, reducing energy and manufacturing costs

APPLICATIONS

The energy-saving lightweight refractory was designed to meet the needs of the manufacturers of china and dinnerware, sanitaryware, porcelain, grinding wheels, electronic ceramics, porous ceramics, and grinding media. Secondary applications might include thermocouple tubes and sheathing for graphite components for the aluminum-processing industry.

NEW REFRACTORY MATERIAL ALLOWS FOR THINNER, LIGHTER, AND MORE COST-EFFECTIVE MANUFACTURING OF KILN FURNITURE

A refractory is a heat-resistant material with a very high melting point that is used in the petroleum, energy conversion, metals, glass, and ceramic industries. One application of refractory material is kiln furniture, including the plates, beams, crucibles, and posts used to support products inside a kiln. Sanitaryware, dinnerware, and porcelain manufacturers all use kiln furniture in the production process to fire their products. In particular, silicon carbide (SiC) kiln furniture offers superior thermal-shock resistance during rapid-firing processes.

Silicon Carbide Products (SCP), Inc. has developed a lightweight refractory material that is expected to yield energy savings of between 25 and 50 percent over traditional SiC material. This new, energy-saving lightweight refractory material is three times stronger than silica or clay-bonded SiC, allowing fabrication of thinner, more lightweight kiln furniture that absorbs less energy during the firing process. Due to its ability to enhance the manufacturing process and lower production costs, this technology is expected to be more cost effective than current recrystallized SiC.

SILICON-CARBIDE KILN FURNITURE



Photo courtesy of Silicon Carbide Products, Inc.

A new refractory material created from a unique silicon and carbide substance yields stronger, thinner, and lighter kiln furniture.



Project Description

Goal: Improve the oxidation and creep resistance of an existing product to allow expansion into new markets, including kiln furniture and aluminum contact applications.

The energy-saving lightweight refractory is expected to reduce energy costs during the firing process, while increasing the ware-to-fire ratio of the kiln. This thinner, stronger material will produce lighter furniture that will reduce the amount of energy absorbed in the firing process. Traditional kiln furniture used in the ceramic industry is made from heavy materials that absorb large amounts of energy. Compared to recrystallized SiC, Silicon Carbide Products' material will be less expensive to produce because it eliminates a second firing, which previously was required to protect the material from oxidation.

In addition to the energy-saving benefits of smaller, lighter furniture, there will be additional energy benefits by reducing the ratio of refractory ware-to-fire products. Smaller furniture will allow for increased kiln efficiency and production capacity. Reduction in energy consumption will lead to less use of natural gas and fewer emissions in the form of CO₂, CO, and NO_x.

Silicon Carbide Products, Inc., is developing this new technology with the help of a grant funded by the Inventions and Innovation Program in the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

Within the refractory market, there are currently no other products exhibiting the same combination of attributes found in Silicon Carbide Products' new material. The company is currently working to perfect two technical achievements—creep and oxidation resistance. A testing line has been constructed at Silicon Carbide Products for testing and prototype manufacturing. The company is building upon the industrial market success of their product called SCProbond™, which has had successful applications in the industry.

Economics and Commercial Potential

According to the 1998 U.S. Census Bureau report on refractories, shipments of non-clay refractories decreased 9 percent to \$1,354.4 million in 1998. Non-clay refractories accounted for 57 percent of the total refractory shipments in 1998. The report also concluded that bricks and shapes continue to be the dominant form of refractories. In terms of non-clay SiC bricks and shapes, the total shipment value in 1998 equalled \$79 million. One important product included in the bricks and shapes category is kiln furniture.

Competition will force companies to seek technology that will improve the efficiency of the production process. One way to improve competitiveness is to reduce energy consumption and improve efficiency of the production process. This invention fulfills the need for low cost, lightweight kiln furniture that not only reduces energy costs, but also increases potential firing capacity of kilns.

There are two main opportunities for Silicon Carbide Products. The company can manufacture the product and distribute the technology independently through its current distribution channels for SCProbond™, and it can license the product to a large manufacturer who would provide a marketing, manufacturing, and distribution network.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

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